

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at www.mda.state.mn.us/maitc.



Grade

High School

Materials/Preparation

- ☐ Handout A – Economics of Planting – one per student
- ☐ Assessment A – Planting Efficiently – one per student
- ☐ Empty or full seed packets – one per student
- ☐ Area to plant annual flowers
- ☐ Annual flowers or other started seedlings
- ☐ Two small baskets
- ☐ Paper clips
- ☐ Garden hand shovels
- ☐ Stopwatch

Gardening Economics and Efficiency

Minnesota K-12 Academic Standards

Social
Studies

9.2.4.7

Resource markets and financial markets; determine wages, interest rates and commodity prices.

Summary/Overview

Students learn technical details about planting seeds or seedlings. They also apply the principle of marginal productivity to planting in the garden.

Garden Connection

Students inspect seeds in the classroom. These seed varieties are plants that might be planted in the garden during the growing season.

Background Information

Many of your students probably have not had the opportunity to plant a garden. By utilizing the information on the back of a seed packet, your school garden has a better chance of success. Seed packets explain details such as when to plant, days to harvest, planting depth, and spacing. If seeds are planted too early they may not survive a cold spring night. Knowing the number of days from planting to harvest allows you to plan when you will be able to harvest your crop. This information can also be used to ensure there is enough time for the plant to produce its crop before the first fall frost. Planting depth is also important. Seeds that are planted too deep will most likely germinate, but may not have enough stored nutrients inside the seed to help the developing seedling reach the surface and sunlight. Plant spacing is important to consider so the plants have access to the resources they require.

Objectives

- Explain the importance of planting depth and spacing.
- Find the marginal productivity of labor in planting a garden.
- Observe the effects of increasing the minimum wage on profit margins.

Fun Fact

Columbus brought squash to Europe from the Americas.



Procedure

Interest Approach

Have two baskets on opposite sides of the classroom. One should have a lot of paper clips in it; the other is empty. Ask for a volunteer. Have him/her move one paper clip at a time from one basket to the other and do as many as he/she can in one minute. Count the paper clips. Then ask for a second volunteer. Have the two students work together to move as many paper clips as they can, one at a time from one basket to the other. Count the paper clips. Do this with three and four volunteers, counting the paper clips after each round. Discuss the results, give the definition of marginal productivity of labor and have students give examples of where they have seen this or may see this occur in school, work, or home.

Marginal productivity of labor is the difference in output due to the addition of one unit of labor.

Summary of Content and Teaching Strategies

Pass out seed packets to students. Have them find the area on the back that lists planting depth and spacing. Ask students to share how deep their seeds need to be planted. Compare difference between types of seed. Ask students how far apart their seeds should be spaced.

Discuss the importance of spacing and allowing plants growing room. If plants are overcrowded they will be short on resources including sunlight, water, and nutrients. Crowded plants are less likely to grow to maturity and produce the desired fruit or vegetable. On the other hand, if plants are spaced too far apart, there is less room in the garden for other plants. Often seeds are planted thicker than the actual desired spacing. This allows for seeds that do not germinate or for weak plants. After the seedlings are established, weak plants can be thinned out. When thinning, hand-pull smaller, weaker-looking plants while leaving sturdy, larger plants.

Seeded areas should be clearly marked. Garden markers can be purchased or made by the students. Either way, they need to be waterproof and clearly visible. The most common way to plant seeds is in rows. Some plants are planted in mounds and the mounds are also put in rows. Plants in rows are easier to distinguish from weeds and allow for gardeners to move between plants when weeding and harvesting. If your school has raised-bed gardens, you may choose to use square foot gardening. The garden is divided into squares one foot by one foot and one type of seed is planted in each section.

Plants can also be transplanted into a garden. Seeds are started early in a greenhouse or under grow lights and are later moved outside. Transplanted seedlings also need to be properly spaced. Plants should be planted the same depth in the garden as in the pot they were growing. If the roots have become bound, gently break apart the root ball allowing the roots to spread when planted in the ground.

Economics of Planting

Guide students through a planting activity that allows them to visualize the concept of marginal productivity of labor. Marginal productivity of labor is the difference in output due to the addition of one unit of labor. Provide students with copies of Handout A. Designate a space in your garden to plant seedlings that have been started in a greenhouse. Start by having one student plant for three minutes. When the time is up, record the number that has been planted in Table One. Next have two students plant for three minutes and record the number that has been planted. Continue this process until five students have planted for three minutes. As more students are added, labor can become specialized with one student digging holes, another gently removing plants from pots, etc. Students then calculate how much money would be needed to pay the employees at two different hourly rates. Two wage levels allow students to explore how wage level impacts the marginal productivity of labor. Encourage further discussion on how wage level impacts unemployment on a macroeconomic level. Assist students in completing the worksheet.

If you are not able to plant, use the data below as an example:

Table 1. Timed Planting Data

# Workers	Time	Flowers Planted/hr.	Wage 1	Wage 2	Tot. Wages 1	Tot. Wages 2
1	3 min.	60 (3 in 3 min.)	\$6.15/hr.	\$8.00/hr.	\$6.15/hr.	\$8.00/hr.
2	3 min.	100 (5 in 3 min.)	\$6.15/hr.	\$8.00/hr.	\$12.30/hr.	\$16.00/hr.
3	3 min.	160 (8 in 3 min.)	\$6.15/hr.	\$8.00/hr.	\$18.45/hr.	\$24.00/hr.
4	3 min.	200 (10 in 3 min.)	\$6.15/hr.	\$8.00/hr.	\$24.60/hr.	\$32.00/hr.
5	3 min.	220 (11 in 3 min.)	\$6.15/hr.	\$8.00/hr.	\$30.75/hr.	\$40.00/hr.

Table 2. Marginal Productivity of Workers (flowers/hour)

# of Workers	1	2	3	4	5
Difference in output due to the addition of one worker	60	40	60	40	20

Table 3. Cost and Profit Per one Hour of Production

Workers	Labor Cost 1	Labor Cost 2	Cost of Plants	Total Cost 1	Total Cost 2	Gross Profits	Net Profit 1	Net Profit 2
1	\$6.15/hr.	\$8.00/hr.	\$45	\$51.15	\$53	\$60	\$8.85	\$7
2	\$12.30/hr.	\$16.00/hr.	\$75	\$87.30	\$91	\$100	\$12.70	\$9
3	\$18.45/hr.	\$24.00/hr.	\$120	\$138.45	\$144	\$160	\$21.55	\$16
4	\$24.60/hr.	\$32.00/hr.	\$150	\$174.60	\$182	\$200	\$25.40	\$18
5	\$30.75/hr.	\$40.00/hr.	\$165	\$195.75	\$205	\$220	\$24.25	\$15

Ask students what they believe is the best number of workers to plant at a time given the data on their worksheet. Have students explain their answers. Discuss why marginal productivity of each additional worker begins to decrease. At a certain point additional workers are not significant benefit and may get in the way. Talk about the impact of marginal productivity on profit.

Review/Summary

Review the following questions with the class:

- Why is planting depth and spacing important?
- What happens when plants are overcrowded?
- What is marginal productivity? How does it apply to planting a garden?
- Why does marginal productivity of workers decrease at a certain point?
- What happens to your profit when wage is increased?

Modifications/Extensions

Plant seeds in your school garden. Before going outside, discuss rules and expectations at the garden. Make sure students read seed packets for planting information. Have students plant the garden in rows and label them with markers.

Sources/Credits

This lesson was developed for the *Minnesota Garden Guide*.

Name _____



Economics of Planting

Fill in the charts below as we conduct the flower-planting tasks as a class. This activity provides a real-world example of marginal productivity of labor.

Table 1. Timed Planting Data

# Workers	Time	Flowers Planted/hr.	Wage 1	Wage 2	Tot. Wages 1	Tot. Wages 2
1	3 min.		\$6.15/hr.	\$8.00/hr.		
2	3 min.		\$6.15/hr.	\$8.00/hr.		
3	3 min.		\$6.15/hr.	\$8.00/hr.		
4	3 min.		\$6.15/hr.	\$8.00/hr.		
5	3 min.		\$6.15/hr.	\$8.00/hr.		

Calculate the hourly marginal productivity of each worker. Marginal productivity of each worker is determined by calculating how many additional flowers the worker in question planted. The marginal productivity of the first worker is the number of flowers they can plant in one hour. The marginal productivity of the second worker is the number of additional flowers that were planted per hour due to having two workers instead of one worker.

Table 2. Marginal Productivity of Workers (flowers/hour)

# of Workers	1	2	3	4	5
Difference in output due to the addition of one worker					

Use the following cost and profit numbers to calculate gross and net profits.

Plant cost: \$.75 per plant Profits: \$1.00 per plant planted

Table 3. Cost and Profit Per one Hour of Production

Workers	Labor Cost 1	Labor Cost 2	Cost of Plants	Total Cost 1	Total Cost 2	Gross Profits	Net Profit 1	Net Profit 2
1								
2								
3								
4								
5								

Name _____

Planting Efficiently



1. Explain the importance of planting depth and spacing.

2. Explain marginal productivity of labor as it relates to planting a garden.

3. Observe the effects of increasing the minimum wage on profit margins.
